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Docket No.: 10731-US-PA
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AMENDMENTS

To the Specification

Please amend the following paragraphs:

[0003] This invention relates in general to a metal oxide nanoparticle sol and a method for preparing the same. More particularly, the invention relates to a zirconia nanocrystal sol and a method for preparing the same.

[0006] The nature of the zirconia (e.g., crystallinity, crystal structure, particle size and degree of primary particle association) governs the optical transmission, refractive index and the loading limit of the nanoparticles in an organic polymer. For a material to remain optical transparent after the incorporation of nanoparticles, the size of the nanoparticles has to be smaller than 1/4 of the wavelength of the incident light, so that light is not scattered. Therefore the requirement of transparency posts an upper limit to the size of the primary and the associated particles. To increase the refractive index of the matrix, the refractive index of the incorporated nanoparticles must be higher than the matrix. In this respect, crystalline zirconia has a higher reflective index than non-crystalline zirconia, and is thus preferred. The refractive index of the matrix can be increased substantially if the loading of zirconia is high. However, the loading limit of a zirconia in a polymer is a function of both particle association and particle size. As particle size increases and/or the association between particles increases, the loading limit of the zirconia in a polymer decreases. Therefore, a method for preparing a sol containing nano-crystalline zirconia without association or having only weak association is important and necessary.

[0007] A stable sol containing non- or weakly-associated zirconia nanocrystals is in general transparent to visible light. However, the pH range where the sol remains stable should be as close to neutral condition as possible, preferably in the range of pH 6~9, for easier application in various fields.

[0008] In a prior art, US patent No. 4,784,794, a method of preparing a translucent zirconia sol by treating zirconium chloride at 130°C or higher is disclosed, but the pH value of the prepared product is lower than 7. Additionally, [[~~the~~]]US 6,376,590 discloses a method of preparing a zirconia sol having high dispersing zirconia crystals by using a zirconium salt solution containing polyether or an organic acid having ether group therein as the starting material. However, the method requires high (140~250°C) temperature and the pH value of the prepared product is lower than 7. Since the process temperature described in the above methods would require the employment of a high-pressure autoclave, a low temperature process for the preparation of zirconia sol is needed.

[0009] Accordingly, an objective of the present invention is to provide a zirconia sol and a method of preparing the same having zirconia nano-crystals that are not associated together or have weak interaction there-between.

[00013] The present invention provides a zirconia sol comprising zirconia crystals having an average primary particles size less than 20 nm, wherein more than 90% of the zirconia

crystals are in the form of tetragonal and cubic crystal lattice structures, and the zirconia sol has a transmittance more than 70% when the amount of the zirconia crystals in the zirconia sol is about 20 wt%.

[0015] The zirconia sol of the present invention comprises of zirconia crystals having an average primary particle size less than 20 nm, without or with only weak association, and is therefore transparent. The average transmittance of visible light can be as high as 70% at a solid content of 20%. The zirconia sol of the present invention is further characterized by a neutral pH value and a lower preparation temperature.

[0019] Figure 1 is a flow chart of a method of preparing a zirconia sol according to an embodiment of the present invention. Referring to Figure 1, in step 100, a first solution containing an inorganic zirconium salt and an organic acid therein is provided, wherein the amount of the zirconium salt in the first solution is about 2~4 mol/L. The zirconium salt in the first solution is, for example, zirconium chloride, zirconium nitrate~~nitride~~, zirconyl hydrochloride~~zirconium hypochloride~~ or other suitable inorganic zirconium salt. The organic acid and the zirconium ions in the first solution have a molar ratio between 0.1~0.25. The organic acid is, for example, monoacid such as formic acid, acetic acid, propionic acid, acrylic acid, methacrylic acid, benzoic acid, salicylic acid; dibasic acid such as tartaric acid; and tribasic acid such as citric acid.

[0022] In step 106, ~~conditioning~~ adjusting the pH of the product to form an acidic slurry

~~mud~~, and the acidic slurry ~~mud~~ has a pH value lower than 3. In the embodiment, the product is adjusted to form the acidic slurry by ~~conditioned to form the acid mud is~~, for example, an organic acid and an organic dispersant ~~dispersing agent may be used for conditioning the product~~, wherein the amount of the organic dispersant ~~dispersing agent~~ in the zirconia sol is about 10 wt% ~ 15 wt% based on the solid weight.

[0023] In step 108, adjust the pH of the acidic slurry ~~mud is conditioned~~ to form a neutral zirconia sol, and the neutral zirconia sol has a pH value between 5~10.

[0025] ~~It is to be noted that b~~Because the zirconia sol of the present invention comprises zirconia crystals having an average primary particle size less than 20 nm, not only the transmittance or reflective index of the zirconia sol can be improved, but also a neutral zirconia sol can be obtained. Moreover, the preparing temperature of the present invention is lower than conventional methods.

[0026] It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing descriptions, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.